[redacted]

Z65-11415

C65 8600

CLASSIFICATION CHANGE

To UNCLASSIFIED
By authority of GDS - E0 11652 Date 12/31/72
Changed by L. Shirley
Classified Document Master Control Station, NASA
Scientific and Technical Information Facility

Accession No. 5419564

Copy No. 126 SID 62-300-22

APOLLO MONTHLY PROGRESS REPORT

(U)

NAS9-150

March 1, 1964

Paragraph 8.1, Exhibit I

Report Period

January 16 to February 15, 1964

[redacted]

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18 U. S. C. Section 793 and 794. Its transmission or revelation of its contents in any manner to an unauthorized person is prohibited by law.

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

[redacted]

[redacted]

CONTENTS

ILLUSTRATIONS

TABLES

[redacted]

PROGRAM MANAGEMENT

STATUS SUMMARY

The Pratt & Whitney prototype integrated fuel cell power plant was successfully operated on load for the first time at S&ID during the report period. The purpose of this initial run was to establish testing procedures and to check out facility operations.

Four water impact drop tests of boilerplate 2 were conducted at the Downey impact test facility during the report period. These tests are part of the current series of water impact drop tests to determine heat shield pressure distribution.

A successful dual drogue parachute drop test, with three main ring-sail chutes installed in a parachute test vehicle, was conducted at the El Centro Naval Air Facility during the report period. The purpose of the test was to evaluate the functioning of the main chutes when deployed with the drogue chutes still attached. One drogue chute collapsed prior to impact, but impact was normal.

Four command module and three service module reaction control subsystem engines completed an 8-week test sequence at the Arnold Engineering Development Center during the report period. Thrust data and temperature profiles were obtained during four separate test periods.

Boilerplate 13 launch escape subsystem, service module, adapter, and associated GSE were airshipped from the Long Beach Airport to Cape Kennedy during this report period. Final shipment of boilerplate 13 will be made during the beginning of the next report period.

Design engineering inspections (DEI) of boilerplates 23 and 15 were held January 29 and 30. Boilerplate 23 is the backup test vehicle for boilerplate 12, whose mission is to verify transonic abort capability; boilerplate 15 is the backup for boilerplate 13, whose mission is to verify Saturn/Apollo launch environment.

A presentation of the block change concept with emphasis on block-II command module changes was given at NASA-MSC on January 21. Block-II changes are defined as those required for compatibility with the lunar excursion module, structural changes to reduce weight or improve center

[redacted]

CONFIDENTIAL

of gravity, and critical system changes. Block-II changes will be divided into four groups. Plans to implement them will be presented in detail during the next report period.

Phase II of the docking simulation studies was completed at NAA-Columbus on January 24. Tests included 170 runs simulating transposition and lunar orbital docking, using stable and unstable targets. Tests were made with two extending probe concepts: flexible cable and rigid boom. Three NASA astronaut subjects participated by flying indoctrination runs for most phases of the simulation.

DEVELOPMENT

AERODYNAMICS

Phase I of a study to determine emergency detection subsystem limits for the launch escape vehicle was completed. Initial angle of attack limits during boost were generated with consideration of booster dispersions, ballast variations, launch escape subsystem (LES) motor variations due to thrust level and alignment tolerances, and pitch control motor effect. Pad abort limits for a cold LES motor were also computed for a diverging booster as a function of the divergence angle and rate. The results indicate satisfactory LES operation up to an initial angle of attack of 15 degrees with 900 pounds of ballast and the pitch control motor active. With the pitch control motor bypassed, the ballast requirement drops to 600 pounds. Continued study will center on improvement of pad abort capability and resolution of the stability problem at high-altitude abort.

Recently acquired Little Joe II booster thrust histories were used to determine the optimum boilerplate 12 test point for simulating abort from a Saturn booster. The selected conditions were Mach number 0.94 and q of 550 pounds per square foot with a launch angle of 87 degrees, which proved unacceptable for range safety reasons. The study was repeated with a maximum launch angle of 84 degrees, resulting in Mach number = 0.94 and q = 586 pounds per square foot. New trajectory data are being generated for these abort conditions.

MISSION DESIGN

Studies of the earth landing sites for lunar returns indicate that a lateral offset position from the initial entry plane is desirable, considering interactions between the primary guidance ranging capability, vehicle response for single and dual reaction control subsystem (RCS) operation, and entry monitor system shaping constraints. The recommended offset is based on restriction of lateral steering to less than circular orbit speeds. For this constraint, the optimum site loci between the minimum and maximum entry range would correspond to the center of the reentry footprint (landing area capability). Preliminary site coordinates from the point of entry are given in Table 1. The tolerance may be allotted to initial azimuth heading errors and system design tolerances during entry.

Table 1. Optimum Lateral Offset of Earth Landing Sites for Lunar Return

Longitudinal Coordinate (NM)	Optimum Coordinate Lateral Offset (NM)
1200	50±40
3000	170±75
5000	250±50

A task force was formed to organize, control, review, and coordinate S&ID support to the Apollo Mission Planning Study assigned to Grumman. Tasks for the development of initial reference mission and control weight mission were reviewed. A system was established for rapid distribution of incoming data from the Grumman director group and coordination of outgoing information from S&ID. Studies in progress include the following:

1. Development of data for the establishment of a new ΔV budget by NASA
2. Matrix of parameters and planning factors affecting weight
3. Evaluation of mission ground rules and the initial reference trajectory prepared by NASA-MSC
4. Attitude criteria
5. Command and service module ground operational support system (GOSS) interface
6. Evaluation of the Grumman recommendation for retention of the lunar excursion module adapter for meteoroid protection
7. Command and service module meteoroid protection
8. Requirements for data on crew tasks performed in a pressurized suit
9. Data on illumination requirements for transposition docking and rendezvous
10. Coordination of Grumman and S&ID contingency analysis procedures

[redacted]

11. Up-dating of the decision interval study

12. Revision of the report on lunar landing mission operational sequences and timelines

The Apollo spacecraft development test program includes several Saturn IB missions that require either maximum command and service module weight in orbit or maximum command and service module entry velocity. An analysis was completed for these cases, where a launch escape subsystem is not included, comparing the maximum command and service module weight in orbit with and without using the service propulsion subsystem (SPS) to perform orbit injection.

The following constraints were used:

1. Launch thrust-to-weight ratio similar for all configurations

2. Total weight above the S-I and S-IVB adapter similar for all configurations (This is believed to be a limiting design load constraint on Saturn IB.)

Two configurations of Saturn IB and SPS (for orbit injection) were studied. One configuration assumed that the various stage propellant loads (within the above constraints) and launch trajectory could be optimized to produce maximum command and service module weight in orbit. The second configuration assumed that the nominal pitch program of the Saturn IB must be maintained through S-IVB cutoff. It also assumed that only propellant weight between the S-IVB stage and the service module SPS could be interchanged to produce maximum command and service module weight in orbit.

Table 2 shows that significant increases of payload (command and service module weight) in orbit are possible with the use of the SPS to assist orbital injection. This increased weight may be converted to increased command and service module entry velocity.

Table 2. Increase in Orbited Payload With Saturn IB and Service Propulsion Subsystem

Increase in Orbital Payload Over Saturn IB Only (lb)	
PROPELLANT AND TRAJECTORY OPTIMIZED	PROPELLANT INTERCHANGE ONLY
3487	2722

~~CONFIDENTIAL~~

CREW SYSTEMS

Two tests were conducted to evaluate equipment stowage locations in command module mock-up 2. A team of two astronaut subjects participated, wearing pressure suits.

In one test, the two subjects (working as a team) in pressurized and unpressurized suits, respectively, simulated procedures for the removal and stowage of docking mechanisms. Preliminary results indicate the feasibility of stowing this equipment in the sleeping station. Additional tests will be conducted to evaluate crew task integration.

In the other test, the subject in the left couch (with his suit deflated) was able to reach, remove and install the backup controllers when they were stowed in the bulkhead, couch side, or headrest locations. When the suit was pressurized, he had difficulty with the bulkhead and couch side locations; the subject in the center couch (with his suit pressurized) was unable to assist.

Visibility of the tape recorder reels in the lower equipment bay was studied. A subject in any couch, with his suit deflated, was able to see the reels and estimate the amount of tape remaining, although he was unable to read the scale numbers on the face of the recorder because of the distance. With the suit pressurized, the subject was able to raise his head enough to see the tape windows but not enough to estimate the remaining amount of tape.

A preliminary astronaut task analysis was completed, providing a timeline analysis for the 14-day lunar landing mission. It is being used to check work overloads and parallel activities. Evaluation of this preliminary document as well as information obtained from the astronauts will be used in preparing the integrated flight crew performance specification, scheduled for completion in early March 1964.

STRUCTURAL DYNAMICS

A study was begun to determine the flotation characteristics of a flooding command module as it takes on water through the side hatch or through a leak in the pressure hull. Preliminary investigation indicated that a fully flooded module has slightly negative buoyancy, but a detailed analysis, including such unknowns as the absorptivity of the ablative material and flooding of honeycomb cells, is necessary to determine definitely whether the module will sink.

A preliminary data package from the PSTL-2 model wind tunnel tests was sent to NASA-MSC and NASA-Ames. This package consisted of duplicate tapes of fluctuating pressure data, system sensitivity information, and transducer calibration curves. Data processing to one-third octave band power spectrum form is in progress at S&ID. The final analysis of data from the PSTL-1 test series was published.

Natural modes and frequencies for the Saturn IB and Saturn V boosters, with Apollo payloads, were calculated to determine any differences in boilerplate and prototype command module stiffness for the spacecraft payload. First- and second-stage vehicles were studied in each case with no significant differences in mode shape or frequency being found for any of the configurations studied. It was concluded that a boilerplate could be substituted for a prototype command module in either S-IB or S-V ground vibration tests, scheduled for MSFC, to evaluate complete booster-spacecraft modes and frequencies.

STRUCTURES

The tensile strength of parachute material is being tested to determine the effects of a vacuum at sea-level ambient temperatures, and temperature variations at sea-level ambient pressures. Samples at S&ID that were subjected to a vacuum of 1.3×10^{-6} millimeters of mercury or more for 3, 4, 6, and 8 days lost only 3.8 percent of tensile strength. Tests are being scheduled to obtain data for longer periods under vacuum and to study the effects of temperature variations at ambient pressure.

Coated and uncoated glass window materials, subjected to a combination of 31-Mev proton radiation, -300 F temperature, and 10^{-9} millimeters of mercury pressure at the University of Southern California proton accelerator, showed no apparent damage to the glass, but the coating acquired a bluish color. Attempts to photograph the radioluminescence caused by radiation were only partially successful.

The program of face sheet and core depth optimization for the S-IVB adapter was completed. For minimum weight, the top portion of the adapter should be 1.72 inches thick, with 0.015-inch face sheets down to the skin splice and 0.018-inch face sheets from the skin splice down to the lunar excursion module attach frame. The lower portion of the adapter from the lunar excursion module attach frame to the instrument unit should be 1.66 inches thick with a face sheet thickness of 0.017 inches.

Forward heat shield separation investigations were made in support of blocks I and II spacecraft. Tests were conducted in the cartridge development program in support of block I. Separation velocities varied from 26.1

CONFIDENTIAL

to 32.2 feet per second, indicating that the cartridge is properly sized for block-I vehicles.

In support of block-II vehicles, trade-off concepts were completed for the thruster system. The studies showed that only 4 pounds of injected mass would be saved by designing a minimum thruster system for normal mission and adding a reaction motor to the launch escape tower to remove the heat shield in abort modes.

The design concept for the lunar excursion module attachment to the spacecraft lunar excursion module adapter was jointly established by S&ID and Grumman at a meeting during the report period.

FLIGHT CONTROL SUBSYSTEM

Stabilization and Control Subsystem

The method of replacing the existing interface connectors of the stabilization and control subsystem (SCS) packages with the new retractable center screw connectors was resolved. (See Figure 1.) The applicable specification control drawings are being revised to show the new retractable screw connectors.

Electronic Interfaces

The contacts and retention clips of the subminiature electrical connectors were redesigned to resolve the contact retention problem. The use of half hard brass for the retention clips instead of copper provides greater stiffness and allows more accurate machining. Production model connectors (Y-models) with the new contacts are now available. Preliminary tests indicate that successful design verification tests should be completed shortly.

Subsystem Analyses

Simulation of the transposition and lunar orbital docking phases using the storable tubular extendible member (STEM) device was completed during the report period. Preliminary data analysis of the transposition phase indicated no significant propellant economy with the STEM device compared with the extendible tether device. The test subjects preferred to use the service module RCS retro thrust when docking with the STEM rather than relying on the compression slip clutch in the STEM to null the closing velocity. The analysis revealed no apparent advantage in either extendible concept over the probe and drogue impact system.

~~CONFIDENTIAL~~

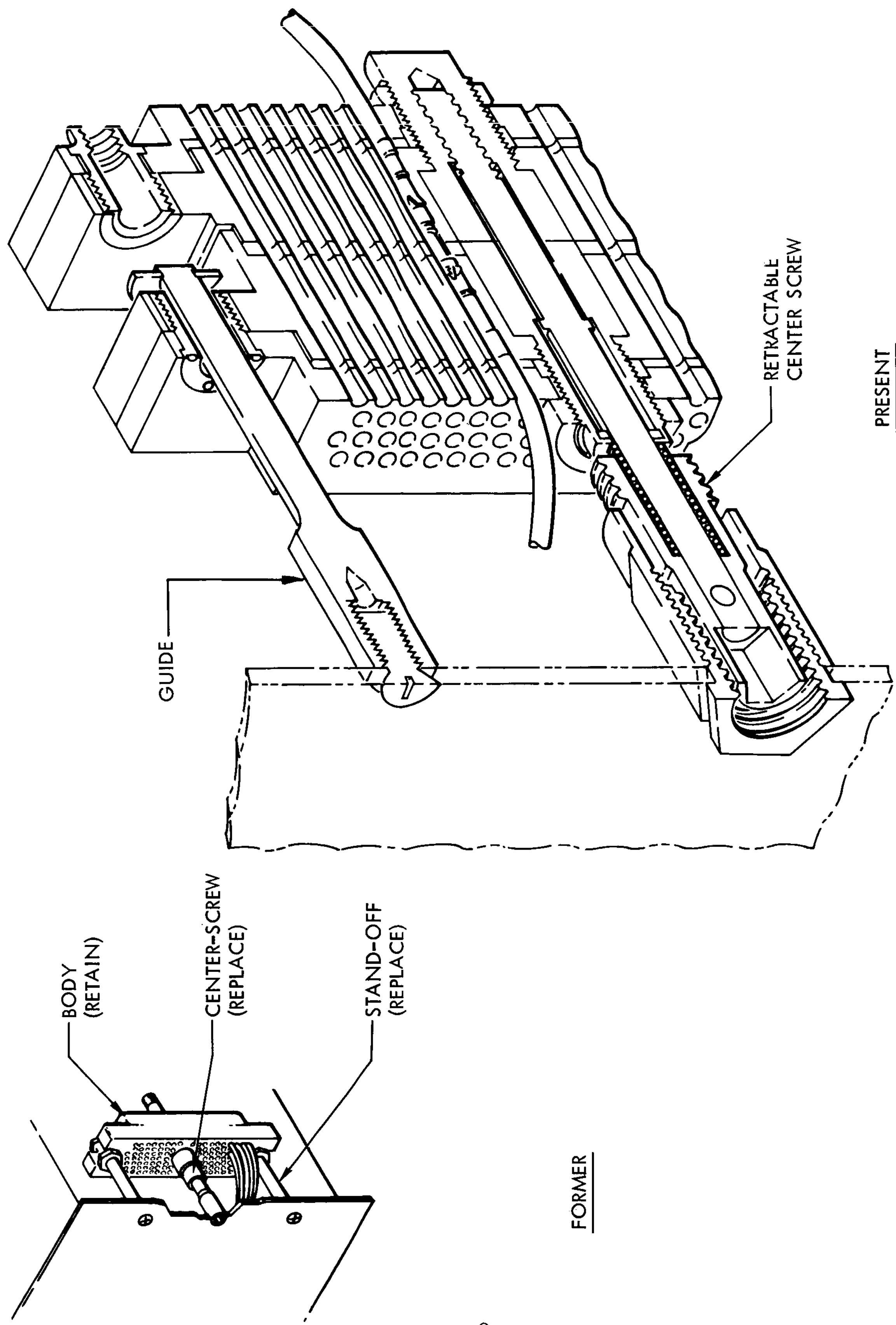


Figure 1. Stabilization and Control Subsystem Interface Screw Connectors

~~CONFIDENTIAL~~

Studies of entry roll rate were completed to define and evaluate SCS modifications that satisfy the roll rate requirement of 20 degrees per second for the stability axis. Based on propellant consumption, ranging accuracy (single and dual RCS), and flexibility, the dual level command limiter modification is considered superior.

TELECOMMUNICATIONS

Communications

The relocation on the service module of the 2-kmc high-gain antenna to a point midway between the RCS engines was completed. The antenna is now located 52 degrees 15 minutes from the -Y axis toward the +Z axis as shown in Figure 2. This places the antenna approximately midway between the RCS engines to minimize heating. It also permits antenna pointing capability to maintain earth communications during navigation sightings.

The preliminary study was completed for redesign of the unified S-band equipment to meet NASA-MSC operational requirements for compatibility with the manned space flight net (MSFN). Results were presented on January 22. To maintain schedules, S&ID proposed limited capability of simultaneous FM and PM mode for block I and full capability for block II. A decision was deferred pending the outcome of equipment compatibility tests to be conducted at Motorola, Phoenix, using the spacecraft unified S-band equipment and the S-band ground equipment.

An up-data link design review was held on January 13 and 14, concerning the reliability program, parts procurement status, packaging, and circuits. Motorola reported that analytical design is 90 percent complete, and circuit testing 80 percent complete. In accordance with NASA directive, a direct display readout from the digital up-data link is being studied. The display is to be a hard copy print-out type independent of the Apollo guidance computer.

Central timing equipment engineering model (E-model) 1 was received January 12 for use in evaluation tests.

Instrumentation

An improvement of 13 weeks was achieved in the negative slack on instrumentation component schedules between December 13 and February 7. A review of each constraining measurement for boilerplate 14, test fixture 2, and spacecraft 001, 006, 008, 009, and 011 was completed. Measures are being taken to further improve the schedule status and to accelerate future design and procurement.

CONFIDENTIAL

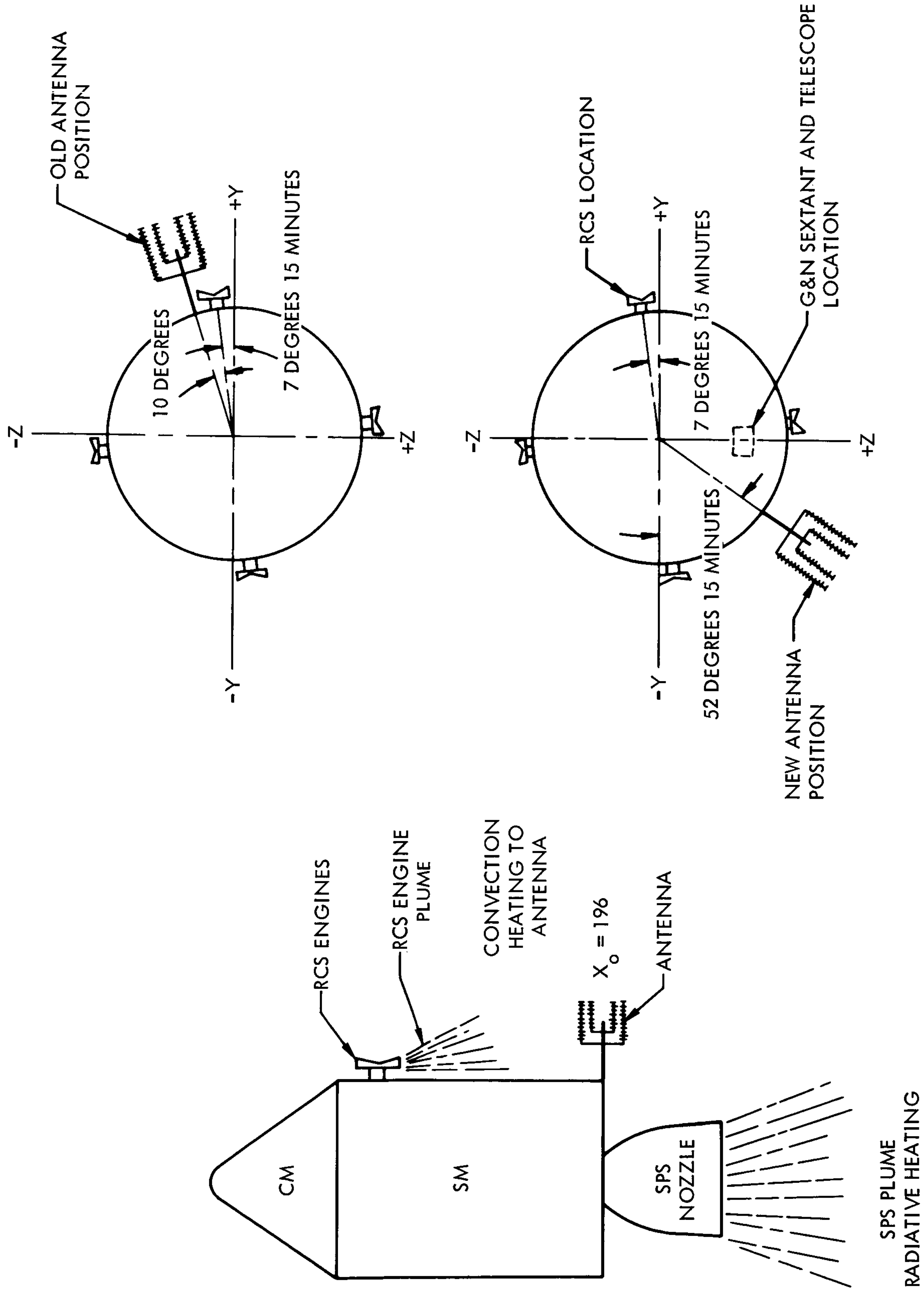


Figure 2. Relocation of 2-Kmc High-Gain Antenna

CONFIDENTIAL

ENVIRONMENTAL CONTROL SUBSYSTEM (ECS)

A manual valve is being designed to pressurize the lunar excursion module before transferring crew members between the command module and the lunar excursion module. The valve, to be located on the command module forward hatch, will be operable from either side of the hatch.

Four ECS radiator panels for spacecraft 006 were successfully pressure tested to 150 psig and leak checked. These panels will be bonded into the service module structure after being cleaned and helium checked for leakage.

All but 1 of 23 coldplates are ready for assembly into boilerplate 14. The last coldplate was eutectically bonded and leak proof tested; it is now in the process of final machining.

A reduction in the insulation requirements of the launch escape subsystem tower tubes was determined using new Buna-N ablative properties obtained from tests. The required uniform insulation thicknesses around the circumference of the tubes vary from 0.184 inches to 0.090 inches for a 550 F tower tube design temperature during a Saturn V boost to a high-altitude abort at 270,000 feet. Corresponding thicknesses for an 800 F tower tube design temperature vary from 0.144 inches to 0.066 inches.

ELECTRICAL POWER SUBSYSTEM (EPS)

A deviation in the entry battery minimum voltage requirements at low temperature was granted Eagle-Picher to avoid a delivery schedule slippage. The low voltage occurs only during the first few minutes of entry. Preliminary analysis indicates that the most critical load subsystem (guidance) can tolerate a reduced dc voltage for a short period. Further study is being made.

Prototype fuel cell tests are under way at S&ID. The first test ran 4 hours load time and included 1 hour at 20, 30, 40, and 50 amperes, successively. The second test was operated under load for 21 hours and the third test reached 88 hours before stopping on February 7. Fuel cell electrical transient response and fuel cell purging data are being obtained in addition to developing operator technique.

Beech completed successful testing of the hydrogen and oxygen cryogenic gas storage fan motor subsystems. Direction will be given to proceed with this design instead of the spherical heaters. This alternate design will result in the elimination of 20 pounds and will provide a more positive method of destratification of the fluid.

An analysis indicated that the surge tank capability exceeds requirements to supply oxygen to the command module (in the event of a loss of atmosphere). The tank must supply oxygen for 5 minutes at 40.2 pounds per hour with a temperature above -60 F. Analysis indicated that the minimum temperature would be -42 F when repressurization occurs at the start of a normal lunar mission. However, the tank has a capacity for supplying oxygen for 6.2 minutes at a temperature as low as -79 F.

A test program was completed to determine the capability of circuit breakers to operate in a 100 percent oxygen atmosphere. It indicated satisfactory performance. A report is being prepared.

A test performed on the launch escape tower of boilerplates 12 and 23 and umbilical installation tests on the command module indicate that the Q-felt and aluminum tape insulation is adequate thermal protection against the high temperature which will occur as a result of impingement when the launch escape motor fires.

Boolean simulation switching studies of the command module and service module power distribution subsystem and the cryogenic gas storage subsystem indicate that both systems will operate as intended.

PROPULSION SUBSYSTEM

Service Propulsion Subsystem

During this report period, 44 firings were accomplished in the injector development program at Aerojet. (See Table 3.) Test results indicate that the POUL-31-39 pattern is the most suitable for further development.

~~CONFIDENTIAL~~

Table 3. Injector Development Test Program, Apollo Service Propulsion Subsystem Engine

Serial Number	Pattern Type	Type of Evaluation	Number of Firings	Number Unstable	Total Time (sec)	Remarks
AX-1	POUL-31-36	C*	4	2	15.4	
AX-2	POUL-41-18	Duration stability	1		200.4	Chamber eroded
		Induced instability	1	1	3.7	4.9 grain pulse. CSM** shutdown. Center hub cracked.
AX-3	POUL-41-19	C*	1		5.8	Rough operation
AX-4	POUL-41-12	C*	1		5.6	
AFF-55	POUL-41-20	C*	3		17.0	
AFF-50	POUL-31-38	C*	3		17.0	
AFF-61	POUL-31-37	C*	3		16.0	
AFF-27	POUL-31-39	Injector chamber compatibility	9		904.0	Streaking evidence
		C*	2		11.0	Chamber pressure oscillation 580 to 600 cps.
AFF-28	POUL-31-39	Performance evaluation	1	1	2.7	CSM shutdown
AFF-29	POUL-31-39	Performance evaluation	2		11.0	Chamber pressure oscillation 600 cps.
AFF-32	POUL-31-39	C*	11		58.0	Modified bleed procedure
00005	Engineering assembly	Balance	5		108.83	
BF-19		Induced stability	2		16.0	Recovered from 156.9 grain pulse during two firings

*Characteristic exhaust velocity
**Combustion stability monitor

~~CONFIDENTIAL~~

Testing of the AJ10-137 engine continued at AEDC, with a modified cooling system being used for the test cell diffuser. Test firings lasted up to 200 seconds. Preliminary data indicate that test cell cooling problems continue during long-duration firings. Corrective modification of the test cell is under way.

Reaction Control Subsystem (RCS)

The final scheduled RCS tests were completed at AEDC. The command module RCS engine run consisted of 31 seconds of calibration, 100 seconds of duty cycle, and 347 seconds of steady-state run. The service module RCS engine run consisted of 6 seconds of calibration, 94 seconds of duty cycle, and 500 seconds of steady-state.

The first development testing of the command module RCS engine incorporating an ablative throat insert was completed at Rocketdyne. Engine performance appeared to be satisfactory throughout a mission duty cycle, including firing time required for propellant disposal before impact.

One each of the four positive expulsion propellant tanks were received at S&ID for assembly in the RCS breadboard test subsystems. One each of the two service module tanks were received at S&ID for the development program of the propellant quantity gauging subsystem.

Phase I of the RCS breadboard test program was completed. The command module test stand is being refurbished for Phase-II tests.

Launch Escape Subsystem Motors

Combinations of two different igniter cartridges (1600 and 2000 psi), with the present as well as a modified pyrogen ignition subsystem, will be tested. These tests involve a new approach to the solution of the tower jettison motor hotwire igniter cartridge problem. The tower jettison motors for boilerplate 12 and the spare were shipped to WSMR on January 24; the launch escape and pitch control motors were shipped on February 7. The tower jettison motors for boilerplates 13 and 16 were shipped to Cape Kennedy on January 23.

Propulsion Analysis

The planned zero-gravity test program for the SPS propellant tank was coordinated with the Air Force at Wright-Patterson AFB at a meeting during the last week of January. Tests will use tenth and three-eighth scale models in the KC-135 aircraft.

Temperatures for service module RCS valves and lines and SPS engine components were calculated for an earth orbit with inertial orientation. The results showed that with the present quad housing design, the RCS components would reach 40 F in approximately 1.5 hours. A thermal control subsystem will be required for missions of more than ten earth orbits.

Rocket chamber ablative material margins for the new command module RCS duty cycles in the automatic steering mode were computed. The results indicate that no change in wall thickness is required.

DOCKING AND EARTH LANDING

Five water impact tests using boilerplate 2 were conducted during the report period. The tests were made to establish the pressure distribution on the command module structure and to facilitate a reliability analysis for water landing. Test conditions comprised descent velocities of 24 and 30 feet per second, horizontal velocities of zero and 34 feet per second, and pitch attitudes of -30 and -20 degrees. Results are being analyzed.

The command module and lunar excursion module crew transfer task simulator was completed during the report period. Tests are being conducted to study the crew tasks involved in removing and replacing hatch covers, in removing the docking mechanism, and in passing through the transfer tunnel. The simulator, used in the docking simulation program, consists of mock-ups of the command module forward access cylinder and of both access sections of the lunar excursion module. Levitation pads provide almost frictionless support on a cushion of air. Counterweighted suspension devices support the man and equipment in the test to simulate weightlessness.

The drogue performance study resulted in a decision to change the drogue interval from 5 to 12 seconds. The change increases the probability of a favorable command module attitude at the time of main parachute deployment. The change also assures that the main parachute deployment will be within the design dynamic pressure envelope.

The dynamic pressure of drogue deployment for block I vehicles was reduced from 140 to 120 pounds per square foot. This change assures that the present drogue and disconnect will be adequate for block I.

The final wind tunnel test plan for the main parachute was completed. Testing started the week of February 10.

GROUND SUPPORT EQUIPMENT

Functional testing of the vertical transport vehicle for the spacecraft was completed at S&ID. Testing was done with a payload of 30,147 pounds, consisting of spacecraft mock-up 11, the GSE support base, and ballast. (See Figure 3.) The vehicle will be shipped to Cape Kennedy to support the earth orbital launch of boilerplate 13.

H14-131-2-A

Figure 3. Spacecraft Vertical Transport Vehicle

A detailed definition was completed for GSE end items involved in weight and balance operations required by mid-April. Because of the critical schedule, additional manpower was applied to effect a timely release of drawings. The present drawing status is as follows:

Drawing	Percent Complete
Spacecraft/service module horizontal weight and balance set	90
Adapter weight and balance support base	100
Weight and balance fixture	70
Spacecraft/service module hoisting fixture	80
Weight and balance beam set	100

The final presentation of the bid evaluations, engineering recommendation, and the combined engineering-purchasing recommendation was made to the resident Apollo spacecraft project office on February 3 in connection with the subcontract for the preflight acceptance checkout equipment (PACE-SC) digital test command system. Initial design was started on the miniaturized data interleaving system. A feasibility study is being made to determine the earliest time prior to launch that PACE-SC carry-on equipment can be removed.

Requirements were established for the system interface between the fluid distribution systems, PACE-SC, and the fluid distribution control units (FDSCU) for launch complex 34 at Cape Kennedy. The FDSCU will be capable of selecting either a local manual control or remote control from PACE-SC; the PACE-SC will have emergency override capability. Both the PACE-SC and the FDSCU will have indication of which is in control of the fluid distribution subsystem. The FDSCU will provide neither the 28-volt dc power nor the signal conditioning required for PACE-SC monitoring. The 28-volt power for valve operation will be provided by the facility. Signal conditioners for valve position indication and transducer measurements will be incorporated in the fluid distribution system.

SIMULATION AND TRAINERS

A simulation of the coast and maneuver flight phase was made using two analog computer sections and evaluator 2. Engineering data was produced to evaluate the following: effects of the man-in-the-loop on propellant consumption; ability to perform maneuvers with regard to prescribed accuracy criteria; ability to perform earth orbital maneuvers using internal controls and displays and to determine procedures for the operation of the spacecraft under various failure modes. This study is to be completed in early March.

The boost and abort flight phase was simulated with the use of four analog computer sections and evaluator 1. The simulation was completely checked out and is currently producing engineering data in regard to SCS and thrust vector control component failures during SPS engine burn phase. This study is to be completed during the next report period.

The preparation of a hybrid simulation of the entry flight phase is nearing completion. The entry simulation involves three analog computer sections, a logic console (HYDAC), the IBM 7040 digital computer, and evaluator 1. This simulation is to be operational by early May.

PROJECT INTEGRATION

S&ID was represented at a spacecraft 008 coordination meeting with NASA at MSC-Houston on January 30 and 31. S&ID presented the need for cryogenics testing in the NASA-MSC thermal-vacuum chamber. Explanation of the vehicle test objectives, detailed test requirements, history of prior testing, conclusions, and test plan were presented. It was agreed that S&ID could use the thermal-vacuum chamber for cryogenics testing provided that a buildup program using gas precedes the tests.

VEHICLE TESTING

Post landing ventilation tests made on boilerplate 1 indicated that natural ventilation may be adequate without the use of powered fans if conditions require the crew to remain in the command module. The tests were made with the command module on its side (120 degree attitude) with the hatch up. Tests for CO_2 concentration were made; parameters included: the metabolic rate of three crewmen subjects, a temperature range from 70 F to 120 F, and various hatch opening restrictions compatible with a sea curtain. Preliminary test results indicate that natural ventilation will accomplish 4.5 and 7.5 air changes per hour with openings of 130 and 315 square inches, respectively. The pretest analysis had predicted 3.15 changes per hour for 95 square inches of opening. Actual test results were better than predicted.

Several water drops were made with boilerplate 2 to determine water pressure magnitude and distribution on the aft heat shield. The data will be used to predict the heat shield mode.

Electromagnetic interference tests on boilerplate 12 were completed February 6. Upon completion of the systems integration tests (now approximately 50 percent complete), the vehicle will be demated, the command module will be weighed, and its c.g. will be determined prior to shipment of the vehicle to WSMR.

Integrated systems tests were completed for boilerplate 13. Figure 4 shows the vehicle undergoing the tests. Shipment to Cape Kennedy is scheduled for early in the next report period.

The command module wiring mock-up for boilerplate 14 is 65 percent complete. Actual cable fabrication was started. The service module fuel cell and the cryogenic system plumbing mock-up were completed. Approximately 60 percent of the wiring mock-up for the service module was completed.

Boilerplate 15 is undergoing changes requested in a design engineering inspection (DEI) January 30. Preshipping tests are scheduled to start early in the next report period.

A DEI on boilerplate 23 was held January 29. After requested changes are completed, limited testing of the individual systems will be started. Available measurement devices will be used. The integrated systems check on boilerplate 23 will begin when GSE equipment used with boilerplate 12 becomes available.

The secondary structures of spacecraft 001 are being installed. The wiring harness and cryogenic plumbing mock-up operations are nearing completion.

The command module primary structure of spacecraft 006 is being bonded. All subassembly details were completed. All details for the service module are complete; the assembly is one-third complete.

The structural subassembly of spacecraft 008 was started. Spacecraft 008 design concepts and problems were resolved. Action was initiated to expedite delivery of components to meet vehicle assembly schedules.

RELIABILITY

Approximately 200 reliability educational publications were supplied to subcontractors as a follow-up to the reliability and quality control symposium held in November. In addition, more than 50 kinescope prints from closed circuit television were supplied for motivation and indoctrination. This support will continue as new material becomes available.

A reliability symposium for Apollo suppliers was held February 10. Suppliers were told the exact meaning of reliability requirements in the procurement package. The agenda included a review of design requirements,

CONFIDENTIAL

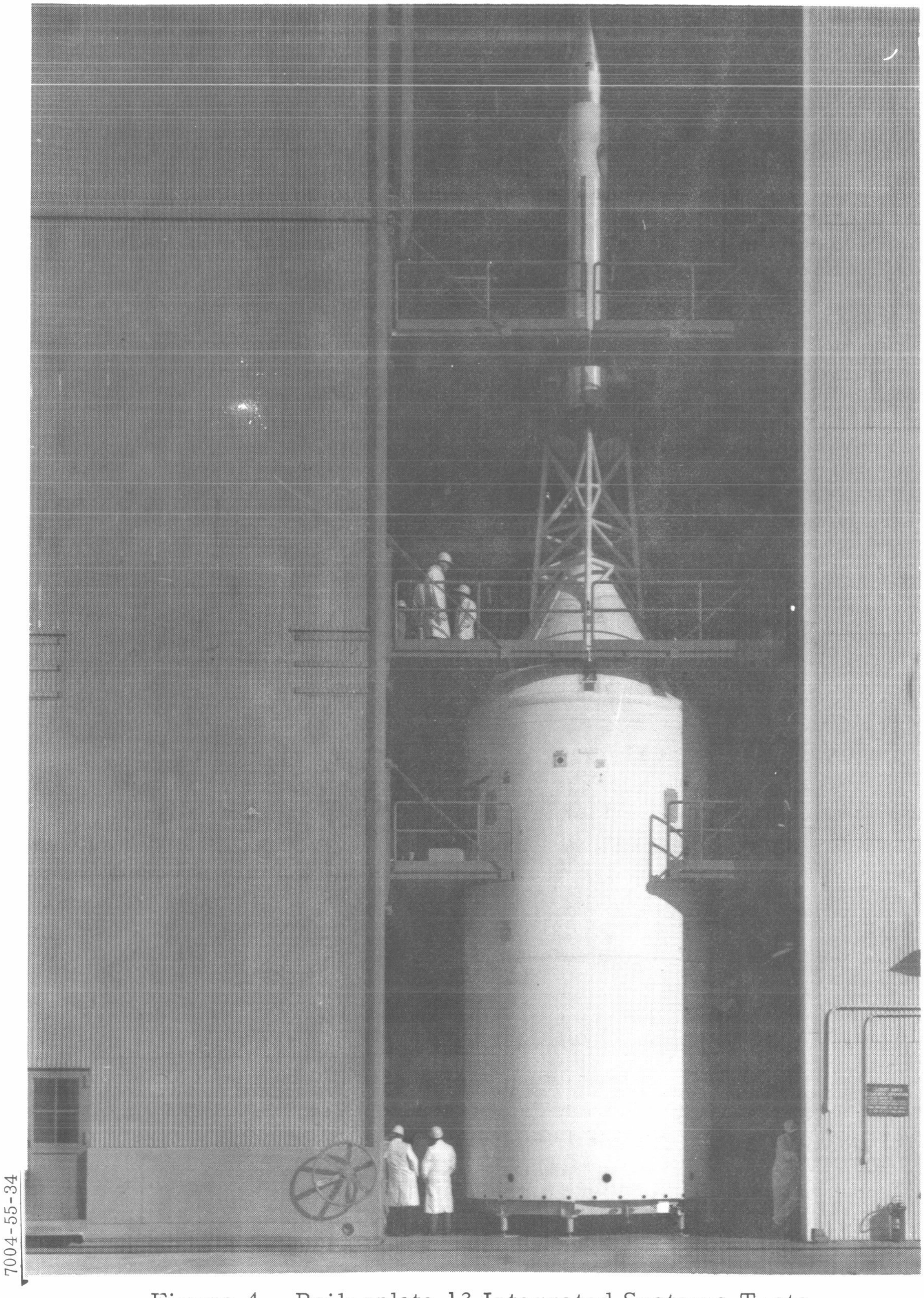


Figure 4. Boilerplate 13 Integrated Systems Tests

failure mode and effect analyses, failure reporting, traceability requirements, design review, reliability assessments, test programs, motivation and training, and documentation requirements.

A design review of the command module RCS was held on January 17. The review included discussion of the possible exposure of the crew to hazardous fumes from trapped propellants in the event of a command module RCS rupture at earth impact. The results of the presentation were as follows:

1. As an interim measure, the current design will proceed without change.

2. No manned flights will be conducted until the matter can be resolved satisfactorily.

3. A detailed study will be made to delineate the problem in full and establish the necessary action to eliminate, reduce, or accept the crew safety hazard.

A major design review of crew systems checkout for the waste management subsystem was held January 24. As a result of this session, it was decided to establish specific requirements for leakage flow measurement and for electrical functional checkout at S&ID and Cape Kennedy facilities. The present capability of the checkout unit restricts its use to measuring the gross leakage of segments of the waste management system. This unit can measure leakage only from 0.1 to 5 cc per minute. The review indicated a waste management system requirement of 0.016 cc per minute maximum allowable leakage for the system backup valve, and a system flow measurement up to 5 standard cubic feet per minute through the vacuum cleaner. These and other requirements, such as functional check of the system blower, the urine disposal lock, and the vacuum cleaner adapter, and electrical functional checkout, will be evaluated to determine what changes are necessary in the checkout unit.

TECHNICAL OPERATIONS

Plans are ready to implement a new system of specifications as the result of S&ID's presentation January 22 to NASA-MSC. The new specification tree is based on a master performance specification, subsystem model specifications, vehicle specifications, performance and interface specifications, and GSE model and equipment specifications.

The task of automating drawing trees for boilerplates through the use of the configuration control master record system is 90 percent complete. A similar program for spacecraft articles is proceeding on schedule.

Twenty-eight GSE-to-facilities interface control documents (ICD) for boilerplate 13 were signed off by NASA-MSC and S&ID, leaving only six of these ICD's to be signed off.

OPERATIONS

DOWNEY

Boilerplate 12

The command and service modules and the launch escape subsystem were mated and stacked in the static test tower for vehicle checkout. The following were performed in accordance with operational test procedures: the functional electrical systems verification and power check; the mate and demate alignment checkout; the GSE function verification; the equipment cooling checkout; the functional checkout of the LES/earth landing subsystem sequencer; and the equipment cooling electromagnetic interference checks.

The integrated systems checkout in the stacked configuration was initiated and completed, except for barometric and mission simulator runs.

Several items of GSE for support of boilerplate 12 operations were released and shipped to WSMR.

Boilerplate 13

The command and service modules, the adapter, and the LES were stacked in the static test tower, and functional checkout was accomplished Validation and checkout of GSE was also accomplished.

The integrated systems testing in the stacked configuration was completed. The boilerplate was then demated and shipping preparations were accomplished. The environmental control subsystem was purged and drained. The boilerplate was painted and delivered to Butler Hangar for shipment to Cape Kennedy. GSE and LES items were shipped to the Florida facility.

Boilerplate 15

The power-on testing has been completed; instrumentation checkout and work-off of open items have been initiated at the manufacturing area. Preparations have been initiated for transferring the boilerplate to the ATO test preparation area and for conducting acceptance testing.

Boilerplate 23

The parachute installations have been completed. The boilerplate was relocated in the manufacturing area for the initiation of design engineering inspection, and for the completion of steps to locate markings of center-of-gravity and weight and balance.

General

The telemetry ground station has completed the data acquisition support task for boilerplate 13. The station has initiated operations in support of boilerplate 12 activities.

During the next report period, mission readiness testing of the integrated systems checkout will be completed. Boilerplate 12 will be prepared and shipped to WSMR. Shipment of boilerplate 13 to the Florida facility will be completed. Boilerplates 15 and 23 will be up-dated as necessary, and prepared for testing. Operational Test Procedures for boilerplates 15 and 23 will be published.

WHITE SANDS MISSILE RANGE

Mission Abort

Preparations for the reception of boilerplate 12 are continuing. Alignment of the command module weight and balance fixture has been completed.

Two tower jettison motors were received at WSMR February 3 and were installed in the bunker.

The buildup of the mission abort battery facility is nearing completion. Proof-loading of the vertical assembly building chain hoist has been completed.

The mechanical portion of the fabrication of the post-launch checkout panel has been completed and electrical installation has been initiated.

Test Fixture F-2

The 100-hour acceptance testing was completed satisfactorily for the analog subsystem of the data acquisition system. Some difficulties were encountered with the digital subsystem.

General

The engine clean tent fabrication has been completed.

Two fork lifts, one mobile crane, one tub, and one winch were proof-loaded at Holloman Air Force Base in preparation for the arrival of boilerplate 12.

FLORIDA FACILITY

Boilerplate 13

Preparations for reception of boilerplate 13 and its associated LES and GSE are continuing; some GSE items have been received.

The cable matrix for the boilerplate 13 cable set has been completed. A cable matrix also is being developed for cabling at pad 37 for boilerplate 13.

The live jettison motors for boilerplates 13 and 16 arrived at the Florida facility and have been placed in storage.

General

Receiving inspection, serialization of modules, and work-off of receiving squawks has been completed for the preflight acceptance checkout equipment (PACE) breadboard digital test monitor system (DTMS). The DTMS J-box between the signal simulator and interleaver has been successfully checked. Circuitry has been added in order to protect the positive-to-negative converter transistor which is used to convert pulse code modulation signal simulator data to negative logic. The interface between the DTMS interleaver and the decommutator has been established and biphase data has been transmitted. The DTMS can now provide support for debugging the computer-to-decommutator interface.

During the next report period, boilerplate 13 and associated LES and GSE will be received. Checkout and test preparation activities will then be initiated.

Revisions to the PACE systems control console layout will be continued.

TEST PROGRAM SUPPORT

The acceptance testing of the Astrodata tape search system was monitored. The system successfully performed each test function and has been accepted. A computer program is being prepared for use of this sytem in Apollo test-data processing.

FACILITIES

DOWNEY

Systems Integration and Checkout Facility

Approximately 60 percent of the total building area of the systems integration and checkout facility is ready for occupancy. Construction is 93 percent complete. (See Figure 5.)

Space Systems Development Facility

The total building of the Space Systems Development Facility is approximately 73 percent complete. (See Figure 6.) Construction of the vibration tower control rooms is being expedited to finish the area one week early to allow S&ID subcontractors to begin installing vibration testing equipment.

Apollo Service Module Test Cell

Construction on the Apollo service module test cell was begun February 14. The scheduled operational ready date is May 8, 1964. This facility will be used for full pressure testing of the electrical power subsystem and the service propulsion subsystem in the service module.

INDUSTRIAL ENGINEERING

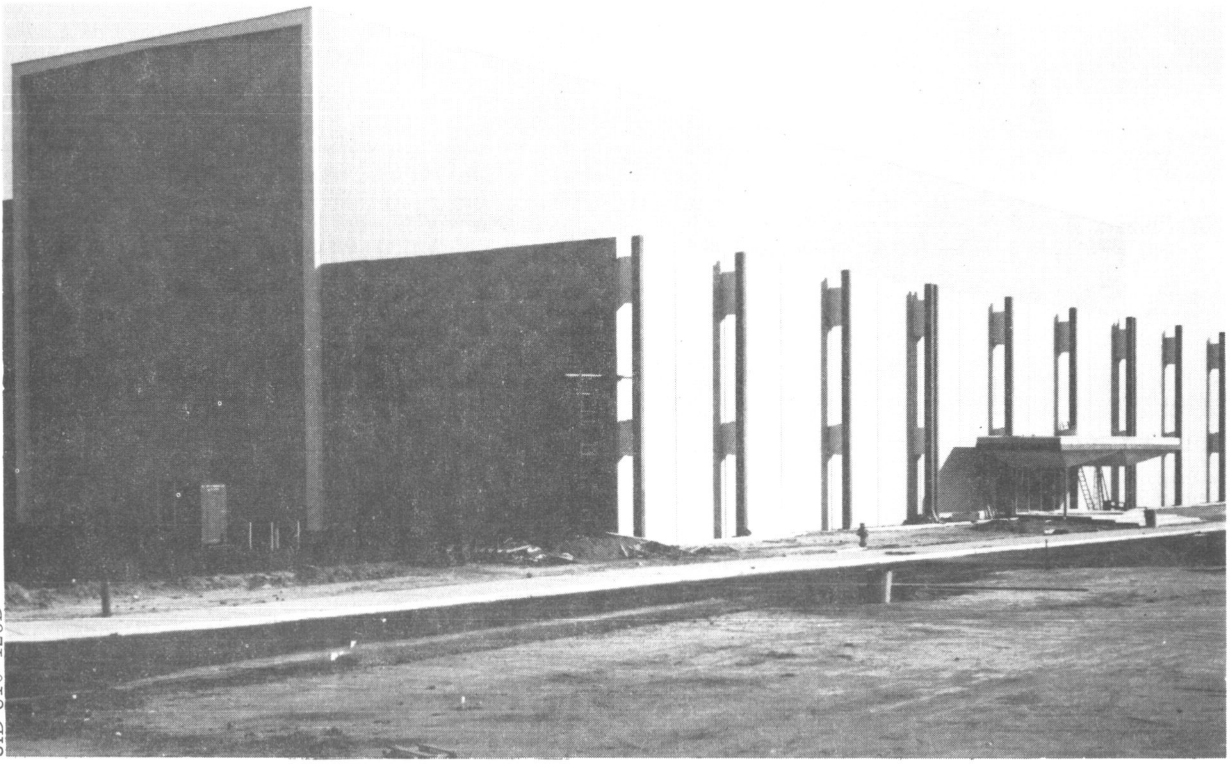
Environmental Control Subsystem Vacuum Chamber Man-Rating

S&ID received NASA approval to proceed with man-rating the ECS vacuum chamber. Man-rating is required to support the ECS breadboard systems test.

Lunar Excursion Module Docking, Phase II

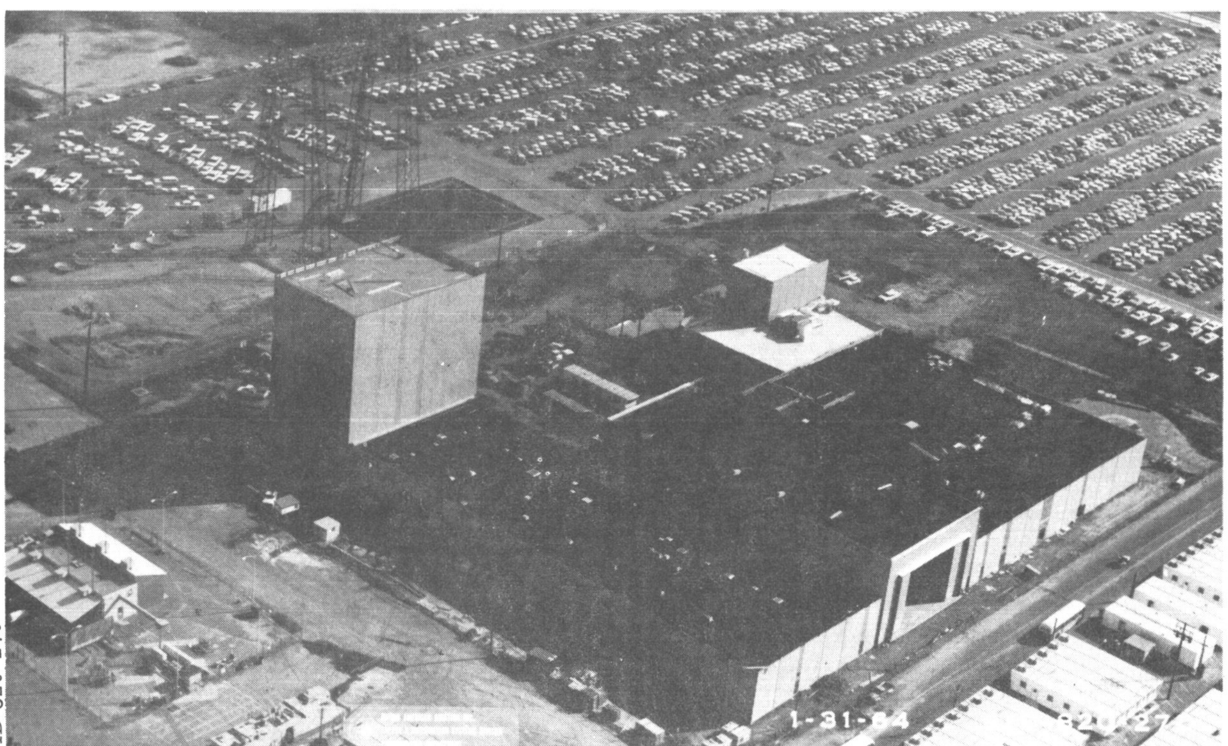
The Facilities Plan to support Phase II of the lunar excursion module docking study calls for use of 24,000 square feet of building area at the Los Angeles Division of NAA. Request for official assignment of the area to S&ID has been submitted.

~~CONFIDENTIAL~~



SID 810-126D

Figure 5. Systems Integration and Checkout Facility



SID 820-270

Figure 6. Space Systems Development Facility

APPENDIX

S&ID SCHEDULE OF APOLLO MEETINGS AND TRIPS

C[redacted]

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964

Subject	Location	Date	S&ID Representatives	Organization
Guidance computer simulation	Mountain View, California	January 16	Dinsmore, Robins	S&ID, NASA
Design fabrication review	Sacramento, California	January 16	Cadwell, Greco	S&ID, Aerojet
Test support requirements	WSMR, New Mexico	January 16, 17	Kennedy	S&ID, NASA
Technical review	Sacramento, California	January 17	Bellamy	S&ID, Aerojet
Crew systems meeting	Houston, Texas	January 19 through 22	DeWitt	S&ID, NASA
Fusion weld equipment acceptance check	Chicago, Illinois	January 20 through 24	Forkos	S&ID, Sciaky
SCS BME design coordination	Minneapolis, Minnesota	January 20 through 24	Colacion	S&ID, Honeywell
Solar radio emission presentation	Houston, Texas	January 20 through 24	Fletcher, Stazer	S&ID, NASA
Technical specification coordination	E. Hartford, Connecticut	January 20 through 24	Nash	S&ID, Pratt & Whitney
SPS subscale facility test program	Tullahoma, Tennessee	January 20 through 24	Hacket	S&ID, AEDC
AMR response system breadboard	Cocoa Beach, Florida	January 20 through 25	Manaker	S&ID, NASA
Technical coordination	Tarrytown, New York	January 20 through 25	Bratfisch, Wagner	S&ID, Simmonds
Propulsion system expediting	Dayton, Ohio	January 20 through 31	Bratfisch, Flanigan, Martini	S&ID, United Aircraft
Boilerplate 13 operations coordination	Cocoa Beach, Florida	January 20 through February 1	Calvert	S&ID, NASA
Electrical and mechanical changes on boilerplate 12 support	WSMR, New Mexico	January 21	Phillips	S&ID, NASA
Nozzle performance evaluation program	Houston, Texas	January 21	Koppange	S&ID, NASA
GSE field support	WSMR, New Mexico	January 21	Bennett	S&ID, NASA
Analog signal conditioners acceptance tests	Seattle, Washington	January 21	Lew	S&ID, Electro Development
Subcontractor surveillance	Melbourne, Florida	January 21	Moore	S&ID, Radiation

[redacted]

~~CONFIDENTIAL~~

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
Crew systems visual requirements and space-suit umbilical meetings	Houston, Texas	January 21, 22	Beam, Brewer, Dziedziula, Roentgen	S&ID, NASA
NAA engineering specification plan for Apollo	Houston, Texas	January 21, 22	Osbon	S&ID, NASA
Block II change briefing	Houston, Texas	January 21, 22	Gustavson, Kinsler, Osbon, Pyle, Skene, Walkover	S&ID, NASA
Data II BME design review	Cedar Rapids, Iowa	January 21 through 23	Moore, Schepak	S&ID, Collins
ATO configuration support coordination	WSMR, New Mexico	January 21 through 23	Keyes	S&ID, NASA
Survey Pratt & Whitney vendors	Norwich, New York Lancaster, New York	January 21 through 24	Williams	S&ID, General Lab Associates, Scott
CWG work task	Cambridge, Massachusetts	January 21 through 24	McKown	S&ID, MIT
Engineering change quotations review and negotiation	Middletown, Ohio	January 21 through 24	Peterson, Stover	S&ID, Aeronca
SGITS up-data link design review	Scottsdale, Arizona	January 21 through 24	Belodis, D'Ausilio, Ridgeway	S&ID, Motorola
Boilerplate 14 end-item acceptance test	Minneapolis, Minnesota	January 21 through 24	Jarvis	S&ID, Honeywell
Schedule investigation	Cedar Rapids, Iowa	January 21 through 24	Hagelberg, Pope	S&ID, Collins
Propellants and gases subpanel	Cape Kennedy, Florida	January 21 through 28	Barajas, Grycel, Lu, Yim	S&ID, NASA
Field analysis	Newbury Park, California	January 21 through 28	Beatty	S&ID, Northrop-Ventura
GSE engineering support	WSMR, New Mexico	January 21 through February 16	Davis	S&ID, NASA
Fluid systems GSE review and support	WSMR, New Mexico	January 21 through February 21	Best, Doles, Frank	S&ID, NASA
Specification plan presentation	Houston, Texas	January 22	Templeton	S&ID, NASA
Discussion of documentation requirements	Houston, Texas	January 22	Miller	S&ID, NASA
S-2 acceptance test procedure, review and negotiations	Shawnee, Oklahoma	January 22	Herschberg, Weir	S&ID, Shawnee

~~CONFIDENTIAL~~

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
Little Joe II operations discussion	San Diego, California	January 22	Wolff	S&ID, Convair
Dynamic stability program review	Sacramento, California	January 22 through 24	Mower	S&ID, Aerojet
Heat shield ablator weight review	Lowell, Massachusetts	January 22 through 24	Conley, Hanifin, Johnson, Lundgren, Morant	S&ID, Avco
NASA/S&ID astronaut training	Houston, Texas	January 22 through 24	Smith, Wolfe	S&ID, NASA
Mission planning task force meeting	Bethpage, New York	January 22 through 24	Jones, Milliken	S&ID, Grumman
14-8 heat shield panels metallurgical problems	Middletown, Ohio	January 22 through 24	Ball, Korb	S&ID, Aeronca
Service propulsion system schedule reviews	Tullahoma, Tennessee Tarrytown, New York Dayton, Ohio	January 22 through 24	Field	S&ID, AEDC, Simmonds, United Aircraft
Motion simulator program review	Shawnee, Oklahoma	January 22 through 24	Brown	S&ID, Shawnee
Heat shield technical interchange meeting	Lowell, Massachusetts	January 22 through 24	Boul, Hanifin, Nixon, Statham	S&ID, Avco
Data storage equipment and premodulation processor, discussion	Cedar Rapids, Iowa	January 22 through 29	Samson	S&ID, Collins
Prequalification humidity test performance and coordination meeting	Melbourne, Florida	January 22 through February 3	Rosenthal	S&ID, Radiation
Parachute drop observation and data acquisition meeting	El Centro, California	January 22 through February 19	Ames, Trebes	S&ID, NASA, Northrop-Ventura
Witness development testing and design review meeting	San Carlos, California	January 23	Gibb, Glavinich, Langager, Lazarus	S&ID, Pelmec
Modification to TVC and EOO test sets, discussion	Minneapolis, Minnesota	January 23	Schroeder	S&ID, Honeywell
Ordnance design meeting	Houston, Texas	January 23, 24	Henke, Miller, Moeller, Necker, Rooten, Sweet	S&ID, NASA
Heat shield ablator weight review meeting	Lowell, Massachusetts	January 23, 24	Kinsler	S&ID, Avco
GSE coordination	E. Hartford, Connecticut	January 23, 24	Waltz	S&ID, Pratt & Whitney

~~CONFIDENTIAL~~

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
FSJ-1 pretest conference	Hampton, Virginia	January 23, 24	Daileda, Moote	S&ID, NASA
Monitor prequalification flight drop tests	El Centro, California	January 23, 24	Bielefeld, Young	S&ID, NASA, USN
Technical coordination	Dayton, Ohio	January 23 through 25	Martini	S&ID, United Aircraft
Witness and discuss testing procedures	Indianapolis, Indiana	January 23 through 25	Arnold	S&ID, Allison
Location of FDS valve boxes and adjacent electrical boxes, electrical subpanel coordination	Cape Kennedy, Florida	January 23 through 30	Schueppert	S&ID, NASA
Boilerplate 12 test operations configuration control record	WSMR, New Mexico	January 23 through February 18	Kosovich	S&ID, NASA
TDY support during boilerplate 13 checkout and launch activities	Cocoa Beach, Florida	January 23 through February 19	Vezirian	S&ID, NASA
RCS engine tests	Tullahoma, Tennessee	January 24	Brandel, Gunter	S&ID, AEDC
Modification of boiler-plate 19 before and after air drops	El Centro, California	January 24 through February 20	Brayton	S&ID, NASA, USN
Level of effort contract discussion	Cape Kennedy, Florida	January 27	Pearce	S&ID, NASA
Manpower requirements discussion	John F. Kennedy Space Center	January 27	Sack	S&ID, NASA
Evaluation of SA-5 launching	Cape Kennedy, Florida	January 27	Vucelic	S&ID, NASA
Investigation of dynamic reliability instantaneous forecasting technique	Williamsville, New York	January 27, 28	Galvin, Kranz	S&ID, Sylvania
Fact finding and documentation meeting	Scottsdale, Arizona	January 27, 28	Blankley	S&ID, Motorola
Propellant tank zero gravity coordination	Dayton, Ohio	January 27, 28	Hines, Lofland	S&ID, NASA
Configuration management requirements coordination and surveillance	Boulder, Colorado	January 27 through 29	Milnes	S&ID, Beech
Delta cost proposal negotiations	Boulder, Colorado	January 27 through 31	Alpert, Bouman, Carter, Tayne	S&ID, Beech

~~CONFIDENTIAL~~

CON[redacted]

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
Witness testing	Buffalo, New York	January 27 through February 9	Burge	S&ID, Bell Aerosystems
Reliability and quality assurance meeting	Houston, Texas	January 28	Griffith-Jones	S&ID, NASA
Meteoroid shield study	Houston, Texas	January 28	Jones	S&ID, NASA
Wind tunnel tests scheduling	Mountain View, California	January 28	Allen	S&ID, Ames Center
Trainer visual displays	Houston, Texas	January 28, 29	Barnett, Hart, LaFrance	S&ID, NASA
Modified pyrogen design review	Elkton, Maryland	January 28, 29	Yee	S&ID, Thiokol
Link Collins subcon-tract negotiation assistance	Binghamton, New York	January 28 through 30	Hatchell, Neff	S&ID, General Precision
Injector development review	Sacramento, California	January 28 through 31	Mower	S&ID, Aerojet
Complex 34 electrical systems review	Cape Kennedy, Florida	January 28 through 31	McArthur, Nielson, Randall, Woodfill	S&ID, NASA
Negotiation changes	Elkton, Maryland	January 28 through February 1	Leonard, Reed	S&ID, Thiokol
FS-3 wind tunnel tests	Tullahoma, Tennessee	January 28 through February 4	Daileda	S&ID, AEDC
BME coordination	Cedar Rapids, Iowa	January 28 through February 21	Hightower, Marine	S&ID, Collins
Systems and manage-ment bimonthly meeting	Houston, Texas	January 29	Cole, Hanifin, Lowry, Skene, Sweet, Underwood	S&ID, NASA
Facility checkout data review	Tullahoma, Tennessee	January 29	Cadwell, Hackett	S&ID, AEDC
Ground test program reworking	Houston, Texas	January 29	Pearce	S&ID, NASA
Bioinstrumentation checkout	San Diego, California	January 29	Atlas, Raggio	S&ID, Scripps General Hospital
S-IVB guidance and implementation meeting	Cambridge, Massachusetts	January 29, 30	Cooper, Louie, Witsmeer	S&ID, MIT
Command system proposal review	Melbourne, Florida Minneapolis, Minnesota	January 29, 30	Guimont, Indelicato	S&ID, Radiation, Control Data

[redacted]

~~CONFIDENTIAL~~

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
Discussion of GOSS error analysis and orbit determination	Houston, Texas	January 29, 30	Louie	S&ID, NASA
Spacecraft 008 coordination meeting	Houston, Texas	January 29, 30	Boykin, Celia, Clauder, Davis, Foust, Gillingham, Gresham, Hodiak, Lundgren, Murphy, O'Brien, Palmer, Stein, Triay, Wilkens, Zuckerman	S&ID, NASA
Entry battery developmental status	Joplin, Missouri	January 29, 30	Champaign, DeVries, Otzinger, Young	S&ID, Eagle-Picher
Proposal review	Melbourne, Florida Minneapolis, Minnesota	January 29, 31	Kerr, Wallace	S&ID, Radiation, Control Data
Contract negotiations	Boulder, Colorado	January 29, 31	Alpert	S&ID, Beech
Launch operations panel meeting	Cocoa Beach, Florida	January 29 through 31	Crawford	S&ID, NASA
Propellant sampling plans and procedures	Sacramento, California	January 30	Martinez	S&ID, Aerojet
Functional requirements review	Houston, Texas	January 30	Abramson, Page, Tyner	S&ID, NASA
Flight technology systems meeting	Houston, Texas	January 30	Crowder, Dodds, Gillies, Sanberg, Vardoulis	S&ID, NASA
Premodulation processor coordination	Houston, Texas	January 30, 31	Sturkie	S&ID, NASA
Controlled cable routing proposal presentation	WSMR, New Mexico	January 30, 31	Hadsall	S&ID, NASA
Mission planning task force meeting	Bethpage, New York	January 30, 31	Hanley, Myers	S&ID, Grumman
Monitor engineering design conference	Framingham, Massachusetts	January 30 through February 3	Brown, Gonzalez	S&ID, Computer Control
DDP-24 digital computer schedule evaluation	Boston, Massachusetts	January 31	Gonzalez, Welldon	S&ID, Computer Control
SPS Program Coordination	Sacramento, California	January 31	Borde, Goodzey, Hope, Melink	S&ID, Aerojet
Evaluation prior to dual drogue modification	El Centro, California	January 31	Beam	S&ID, NASA, USN

~~CONFIDENTIAL~~

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
SC development test plan coordination	Houston, Texas	January 31	Clary, Perkins, Ryker, Sherman	S&ID, NASA
Zero G briefing	Sunnyvale, California	January 31	Gluck, Simkin	S&ID, Lockheed
Monitor engineering design review conference	Raleigh, North Carolina	January 31, February 1	Champagne, Large, Scott, Young	S&ID, Electric Storage Battery
Boilerplate 13 GSE support	Cocoa Beach, Florida	February 2	Miller, Shaw	S&ID, NASA
Configuration control, change control, familiarization	Cocoa Beach, Florida	February 2 through 10	Remington	S&ID, NASA
Visual simulation coordination	New York, New York	February 3	Selby	S&ID, Farrand
Television BME design review	Princeton, New Jersey	February 3, 4	Gill, Kolb, Moreno	S&ID, RCA
PACE-S/C systems test meeting	Cocoa Beach, Florida	February 3, 4	Bunge, Gebhart	S&ID, NASA
Up-data link status and S-band transponder equipment review	Scottsdale, Arizona	February 3 through 5	Hagelberg	S&ID, Motorola
Associate contractors meeting	Cocoa Beach, Florida	February 3 through 5	Githens, Larsen	S&ID, NASA
Contract change negotiation	Buffalo, New York	February 3 through 5	Moore	S&ID, Bell
Pre-installation acceptance procedures establishment	Cocoa Beach, Florida	February 3 through 5	Everett, Gardner, McKim, Patrick, Pollard	S&ID, NASA
Checkout panel meeting	Houston, Texas	February 3 through 6	Bunge	S&ID, NASA
Associate contractor meeting configuration management requirements coordination	Cedar Rapids, Iowa	February 3 through 6	Campbell	S&ID, Collins
Aerospace medicine lecture	Brooks AFB, Texas	February 3 through 7	Wells	S&ID, NASA
Technical coordination and design review	Hightstown, New Jersey	February 3 through 8	Kolb	S&ID, RCA
Dynamic stability program coordination	Sacramento, California	February 3 through 14	Mower	S&ID, Aerojet

~~CONFIDENTIAL~~

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
Coordination meeting and proposals	E. Hartford, Connecticut	February 3 through 14	Garnett, Wermuth	S&ID, Pratt & Whitney
Boilerplate 13 engineering support	Cocoa Beach, Florida	February 3 through 15	Baum	S&ID, NASA
Boilerplate 12 engineering-operational support	WSMR, New Mexico	Beginning February 3	McFarland	S&ID, NASA
Schedule review	Scottsdale, Arizona	February 4	Covington	S&ID, Motorola
Observation of parachute drop tests	El Centro, California	February	Young	S&ID, NASA, USN
Service propulsion engine status coordination	Sacramento, California	February 4	Borde, Cadwell, Field, Ross, Wolfelt	S&ID, Aerojet
Heat shield instrumentation discussion	Houston, Texas	February 4	Boothe, Temoyan	S&ID, NASA
Parachute drop tests monitoring	El Centro, California	February 4	Close	S&ID, NASA, USN
SM reaction control subsystem meeting	Houston, Texas	February 4	Lu, Lum, Gibb, Peterson	S&ID, NASA
Discussion of test plans	Mountain View, California Palo Alto, California	February 4	Monda, Schurr	S&ID, Vidya, Ames Research Center
Rendezvous radar equipment discussion	Bethpage, New York	February 4	Damm, Goldman	S&ID, Grumman
Field analysis	Newbury Park, California	February 4 through 6	Beatty	S&ID, Northrop-Ventura
Proposed canard abort recovery system coordination	Houston, Texas	February 4 through 6	Wiltse	S&ID, NASA
Test procedure qualification	Lima, Ohio	February 4 through 6	Arellano, Vermill	S&ID, Westinghouse
Development test plan meetings	Huntsville, Alabama Bethpage, New York	February 4 through 8	Graham, Ryker	S&ID, NASA Grumman
Boilerplate 12 camera system finalization	Houston, Texas	February 4 through 8	Dacus	S&ID, NASA
Ring-sail parachute tests	Mountain View, California	February 4 through 19	Biss	S&ID, Ames Research Center
Gimbal actuator design review	Sacramento, California	February 5	Davidson, Roznos, Tolly	S&ID, Aerojet

~~CONFIDENTIAL~~

[redacted]

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
Manpower and funding projection meeting	Houston, Texas	February 5	Carroll, Feltz, Olson, Osbon	S&ID, NASA
Delivery schedules review	Middletown, Ohio	February 5	Mihelich, Stover	S&ID, Aeronca
SCS entry analysis coordination	Minneapolis, Minnesota	February 5, 6	Jansz, Ruiz	S&ID, Honeywell
Contamination meeting	E. Hartford, Connecticut	February 5, 6	Orr	S&ID, Pratt & Whitney
Follow-on contract discussion	Middletown, Ohio	February 5, 6	Fleetwood, Smith	S&ID, Aeronca
Discussion of radiation belts	Albuquerque, New Mexico	February 5, 6	Strahan	S&ID, NASA
Pretest conference	Tullahoma, Tennessee	February 5, 6	Moote	S&ID, NASA
Checkout panel meeting 8	Houston, Texas	February 5, 6	Allen, McMullin, Siwolop	S&ID, NASA
Crew provision and environmental control system briefing	Houston, Texas	February 5 through 7	Brewer, Erickson, Hair, Kinsler, Laubach, Stelzriede Tarr, Wells	S&ID, NASA
C&D Subsystem equipment mechanical design discussion	Cedar Rapids, Iowa	February 5 through 7	Kahne, Zahn	S&ID, Collins
SPS qualification test	Indianapolis, Indiana	February 5 through 10	Dean, Ives	S&ID, Allison
CDC 3200 computer evaluation	Minneapolis, Minnesota	February 6	Smith	S&ID, Control Data
Combustion instability briefing	Sacramento, California	February 6	Beltran, Frankel, Simkin	S&ID, Aerojet
Ground test program working relationships	Houston, Texas	February 6	Pearce	S&ID, NASA
Reevaluation of problem schedules	Minneapolis, Minnesota	February 6	Franke, Miller, Walli	S&ID, Control Data
Proposal coordination	Sacramento, California	February 6	Colston, Field	S&ID, Aerojet
Engineering coordination of drawings and fabrication review	Middletown, Ohio	February 6, 7	Confer, Harrison Nelson, Walkover	S&ID, Aeronca
Propellant utilization and quantity gauging meeting	Tarrytown, New York	February 6, 7	Fetters	S&ID, Simmonds

[redacted]

[redacted]

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
Prequalification flight drop tests	El Centro, California	February 6, 7	Bielefeld, Young	S&ID, NASA, USN
Joint LEM CSM external visual docking discussion	Bethpage, New York	February 6, 7	Beam, Spindell	S&ID, Grumman
Coordination of mission simulator computers	Teaneck, New Jersey	February 6, 7	Hatchell	S&ID, Computronics
Discussion of dynamically stable injector program	Sacramento, California	February 6, 7	Briggs	S&ID, Aerojet
Discussion of PIA plan differences	Cocoa Beach, Florida	February 6 through 8	Gardner	S&ID, NASA
EMI specification discussion	Houston, Texas	February 6 through 8	Frankos, Neilan	S&ID, NASA
Software status review	Teaneck, New Jersey	February 6 through 8	Dudek, Fairchild, Hatchell	S&ID, Computronics
SCS BME activity monitoring	Minneapolis, Minnesota Tarrytown, New York	February 6 through 14	Svegel	S&ID, Honeywell, Simmonds
TF-2 GSE facility verification and TF-2 test complex 1 information	WSMR, New Mexico	February 6 through 14	Kischer	S&ID, NASA
Development tests	San Carlos, California	February 7	Lazarus, Roban	S&ID, Pelmec
Pressure suit indoctrination	San Diego, California	February 7, 8	McLean, Nelson	S&ID, USN
Conduct ring-sail parachute tests	Mountain View, California	February 7 through 19	Emerson, Kaiserauer, Yost	S&ID, NASA
Boilerplate 13 GSE support	Cocoa Beach, Florida	February 8	Corpening	S&ID, NASA
Coordination of wind tunnel tests	Mountain View, California	February 10	Cameron	S&ID, Ames Research Center
S-band power amplifier, design review	Cedar Rapids, Iowa	February 10, 11	Hall	S&ID, Collins
Facilities meeting	Cocoa Beach, Florida	February 10 through 13	Minick	S&ID, NASA
Review of qualification and acceptance test procedures	Boulder, Colorado	February 10 through 14	Furrow, Low, Manyak, Weddington	S&ID, Beech

[redacted]

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
PACE computer programming requirements	Cocoa Beach, Florida	February 10 through 14	Largent, Stratton	S&ID, NASA
Monthly coordination meeting	Rolling Meadows, Illinois	February 10 through 15	Banta, Cason, Forrette, Idleman, Schiavi, Traver	S&ID, Elgin
GSE familiarization and SITE activation	Cocoa Beach, Florida	February 10 through 15	Bailey	S&ID, NASA
AMS telemetry system meeting	Dallas, Texas	February 10 through 19	Selby	S&ID, Collins
Contingency analyses for pertinence to AMPTF activities	Daytona Beach, Florida	February 11, 12	Maher, Vucellic	S&ID, General Electric
Saturn V human engineering splinter meeting	Huntsville, Alabama	February 11, 12	Henry, Richardson, Tooley	S&ID, NASA
Safety meeting	Houston, Texas	February 11, 12	Beahm, Poage	S&ID, NASA
Exhibit G development	WSMR, New Mexico	February 11, 12	Kennedy	S&ID, NASA
Proposal analysis	Newbury Park, California	February 11 through 13	Beatty	S&ID, Northrop-Ventura
Test site coordination	Cocoa Beach, Florida WSMR, New Mexico	February 11 through 14	Brandi	S&ID, NASA
GSE site activation and GSE problem coordination	Cocoa Beach, Florida Houston, Texas	February 11 through 14	Lindley	S&ID, NASA
Acceptance test evaluation	Minneapolis, Minnesota	February 11 through 14	Dyson, Jandrasi, Knobbe, Maxwell, Murphy, Pimple, Stiles, Watson	S&ID, Honeywell
Boilerplate 13 GSE support	Cocoa Beach, Florida	February 12	Embody	S&ID, NASA
Ablator ground test data evaluation	Houston, Texas	February 12	Statham	S&ID, NASA
Resident project engineer	Sacramento, California	February 12	Borde	S&ID, Aerojet
Electrical integration panel meeting	Houston, Texas	February 12, 13	Courtis, Crawford, Shelley	S&ID, NASA

~~CONFIDENTIAL~~

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
SPS design coordination	Sacramento, California	February 12, 13	Sorensen	S&ID, Aerojet
S14-043 installation status review	WSMR, New Mexico	February 12 through 14	Knoll	S&ID, NASA
Boilerplate 22, discussion	WSMR, New Mexico	February 12 through 14	Brooks, Wolff	S&ID, NASA
Change proposal	College Park, California	February 12 through 14	Briggs, DeVries Parry, Shaw	S&ID, Radcom
GSE integration on boilerplates and airframes 009	Cocoa Beach, Florida	February 12 through 14	Harkins	S&ID, NASA
Pad schedule for boilerplate 22, discussion	WSMR, New Mexico	February 12 through 14	Martin	S&ID, NASA
Boilerplate 12 flight test coordination	WSMR, New Mexico	February 12 March 9	Chaves	S&ID, NASA
Spacecraft development test plan	Houston, Texas	February 13	Perkins, Ryker	S&ID, NASA
Investigation of gas leakage past O-ring	Elkton, Maryland	February 13, 14	Sztukowski	S&ID, Thiokol
Design review meeting	Houston, Texas	February 13, 14	Whitehead	S&ID, NASA
Tower jettison motors receiving	Cocoa Beach, Florida	February 13, 14	Sumner	S&ID, NASA
Administrative and engineering design review	Metuchen, New Jersey	February 13, 14	Beisner, Bradanini, Musso	S&ID, Applied Electronics
Mission abort area meeting	WSMR, New Mexico	February 13, 14	Rogers	S&ID, NASA
PCM subsystem design review	New Brunswick, New Jersey	February 13, 14	Bradanini, Graham, Kluth, Musse	S&ID, Applied Electronics
Electromagnetic interference requirements coordination	Tarrytown, New York	February 13 through 17	Pumphrey	S&ID, Simmonds
Brazed steel panel engineering assistance	Middletown, Ohio	February 13 through 21	Nixon	S&ID, Aeronca
Shipment of anthropomorphic test dummies	Long Island City, New York	February 13 through 27	Flegal, Wishon	Alderson
SPS test program coordination	WSMR, New Mexico	February 14	Gallanes, Milam	S&ID, NASA

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

S&ID Schedule of Apollo Meetings and Trips
January 16 to February 15, 1964 (Cont)

Subject	Location	Date	S&ID Representatives	Organization
Television camera integrated circuit design review	Scottsdale, Arizona Sunnyvale, California	February 14	Dolce, Green, Purcell	S&ID, Motorola, Signetics
GSE specifications conference	Houston, Texas	February 14	Morland	S&ID, NASA
Mission planning task force meeting	Bethpage, New York	February 14	Meston, Millikon	S&ID, Grumman
Status report support	Houston, Texas	February 14, 15	McCabe	S&ID, NASA
Cryogenic storage system tank test	Boulder, Colorado	February 14 through 16	Bojic	S&ID, Beech
Personnel interview and test specification review	Akron, Ohio Dayton, Ohio	February 14 through 21	Neff	S&ID, Wright-Patterson AFB
Boilerplate 13 support operations	Cocoa Beach, Florida	February 15	Thomas	S&ID, NASA

~~CONFIDENTIAL~~